



# P - B - L S c i E N C E !

## PROBLEM - BASED LEARNING

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### Crust to Core Tour

#### The Problem

A group of Texas geologists, members of the Rock-On geology group, are assisting in designing exhibits and tours for a new "Explore Your Planet Museum." The geologists are sponsoring a contest for sixth grade students to submit a parking lot-sized scale model of Earth's interior, with an accompanying educational narrative script for their "From Crust to Core" tour exhibit. All requirements for the "From Crust to Core" competition are detailed in the accompanying application form.

#### Guiding Question

What are the names and major characteristics of the structural layers of Earth?

#### Mission Deliverable

Your group will create a 2-dimensional (2D) scale model of Earth's structural interior. This model should be accompanied by an interactive narrative that describes the characteristics of each of the layers of Earth.

#### Key Concepts Addressed

As Earth cooled and formed a planet, the less dense elements of the crust and mantle separated, forming layers around the dense core.

The crust and mantle are composed primarily of the elements, oxygen, and silicon known as silicates. Silicates of the mantle contain heavier elements, making them more dense than those found in the crust. The core is composed of the most dense materials, primarily iron and nickel.

The outer core is in the liquid state, and the inner core is in the solid state of matter.

The lithosphere is found in the solid state and is a layer that contains all of the crust and a little of the upper mantle.

#### Performance /College & Career Readiness Goals

##### Science Standards

- IX. Earth and Space Sciences
  - A. Earth's Systems
    - 1. *Know the major features and characteristics of atmosphere, geosphere, hydrosphere and biosphere.*
    - 2. *Describe the characteristics that identify and distinguish the core, mantle, and crust including their locations, compositions, and interactions with each other.*

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Crust to Core Tour Student Checklist

<p style="text-align: center;"><b>Getting Started</b></p> <p style="text-align: center;"><a href="#"><u>Plate Tectonics: Further Evidence</u></a></p> <p style="text-align: center;">Bill Nye Videos:</p> <p style="text-align: center;"><a href="#"><u>The Earth's Crust: Part 1</u></a></p> <p style="text-align: center;"><a href="#"><u>Bill Nye Videos: The Earth's Crust, Part 2</u></a></p> <p style="text-align: center;"><a href="#"><u>Bill Nye Videos: The Earth's Crust, Part 3</u></a></p>	<p style="text-align: center;"><b>Resources (Internet)</b></p> <p style="text-align: center;"><a href="#"><u>The Planet Earth: "About Earth's Layers"</u></a></p> <p style="text-align: center;"><a href="#"><u>The Earth's Layers: "One Layer at a Time"</u></a></p> <p style="text-align: center;"><a href="#"><u>"Structure of the Earth"</u></a></p> <p style="text-align: center;"><a href="#"><u>Earthquakes: Inside the Earth</u></a></p>
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TASK	RESOURCES	DUE DATE	STATUS/NOTES
Brainstorm and complete the KWL Chart.	KWL Chart		<input type="checkbox"/> Complete <input type="checkbox"/> Not Complete
Complete Layers of Earth Chart and accurately draw the scale model of structural layers of Earth on assigned area of parking lot.	Mac or PC Computer Internet		<input type="checkbox"/> Complete <input type="checkbox"/> Not Complete
Develop the script for the "Crust to Core Tour."	Mac or PC Computer with the MS Word Application Internet Related Internet Resources		<input type="checkbox"/> Complete <input type="checkbox"/> Not Complete
Using your "Scale Model of Earth's Interior, lead the class on your "Crust to Core Tour."	Completed "Crust to Core Tour Script Rock Samples (or Pictures of Rocks)		<input type="checkbox"/> Complete <input type="checkbox"/> Not Complete
<b>FINAL DUE DATE:</b>			

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### Crust to Core Tour Rubric and Grade Sheet

Category	Exceeds Expectations 3 points	Meets Expectations 2 points	Below Expectations 1 point	SCORE	Teacher Comments
<b>Content Mastery</b>	Included detail on <b>all</b> components and SCOPE Key Concepts.	Included some detail on <b>most</b> components and SCOPE Key Concepts.	Included <b>little to no</b> detail on components and SCOPE Key Concepts.		
<b>Application of Content</b>	Student correctly supported <b>all</b> SCOPE content AND goals.	Student correctly supported <b>most</b> SCOPE content AND goals.	Student <b>did not</b> support SCOPE content AND goals.		
<b>Research</b>	All information is accurate and is taken from at least 4 sources.	Most information is accurate and is taken from 2-3 sources.	Little to no information is accurate and is taken from one to no sources.		
<b>Presentation</b>	Final product is attractive, all components are easily identified, and the student can clearly dialogue about the project.	Final product is somewhat attractive, most components are easily identifiable, and the student can somewhat dialogue about the project.	Final product is not presented well, components are difficult to identify, and the student cannot clearly dialogue about the project.		
				<b>TOTAL SCORE:</b>	

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### Appendix: Crust to Core Tour Internet Resources

RESOURCE	URL/Resource
Plate Tectonics: Further Evidence	<a href="http://www.teachersdomain.org/asset/ess05_vid_wegener2/">http://www.teachersdomain.org/asset/ess05_vid_wegener2/</a>
Bill Nye Videos: The Earth's Crust, Part 1	<a href="http://www.neok12.com/php/watch.php?v=zX5d6c706d0f75560f7e1a51&amp;t=Earth">http://www.neok12.com/php/watch.php?v=zX5d6c706d0f75560f7e1a51&amp;t=Earth</a>
Bill Nye Videos: The Earth's Crust, Part 2	<a href="http://www.neok12.com/php/watch.php?v=zX4775557b74506a01770302&amp;t=Earth">http://www.neok12.com/php/watch.php?v=zX4775557b74506a01770302&amp;t=Earth</a>
Bill Nye Videos: The Earth's Crust, Part 3	<a href="http://www.neok12.com/php/watch.php?v=zX7e0f4c0678076255725e5d&amp;t=Earth">http://www.neok12.com/php/watch.php?v=zX7e0f4c0678076255725e5d&amp;t=Earth</a>
The Planet Earth: "About Earth's Layers"	<a href="http://library.thinkquest.org/28327/html/universe/solar_system/planets/earth/interior/layers_of_earth.html">http://library.thinkquest.org/28327/html/universe/solar_system/planets/earth/interior/layers_of_earth.html</a>
The Earth's Layers: "One Layer at a Time"	<a href="http://volcano.oregonstate.edu/vwdocs/vwlessons/lessons/Earths_layers/Earths_layers1.html">http://volcano.oregonstate.edu/vwdocs/vwlessons/lessons/Earths_layers/Earths_layers1.html</a>
"Structure of the Earth"	<a href="http://scign.jpl.nasa.gov/learn/plate1.htm">http://scign.jpl.nasa.gov/learn/plate1.htm</a>
Earthquakes: Inside the Earth	<a href="http://www.thetech.org/exhibits_events/online/quakes/inside/">http://www.thetech.org/exhibits_events/online/quakes/inside/</a>

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Student Document #1

**Rock-On Geology Group**  
**5280 Igneous Lane**  
**Rock City, TX 77000**

Dear \_\_\_\_\_ (your school name) Students:

Rock-On is a Texas group of geologists who have been asked to submit ideas for interactive learning experiences for the new Explore Your Planet Museum scheduled to be opened in a city near you in the near future. Rock-On is proud to announce that your class has been selected to submit ideas for a key museum exhibit entitled "From Crust to Core Tour." The project requirements are detailed in the accompanying documents. If your ideas are selected for the interactive learning component of the exhibit, each member of the group will be invited Guests of Honor at the Grand Opening Gala. At this event, you will receive an appropriate award for your efforts in creating an interactive learning experience that will leave a lasting impression on every guest visiting the Explore Your Planet Museum. We are looking forward to receiving your application and your script for the exhibit "From Crust to Core Tour."

Sincerely,

Corey Center  
President and CEO  
Rock-On Geology Group

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Student Document #2, Parts 1 and 2

### Part 1 - Exhibit Title: From Crust to Core Tour

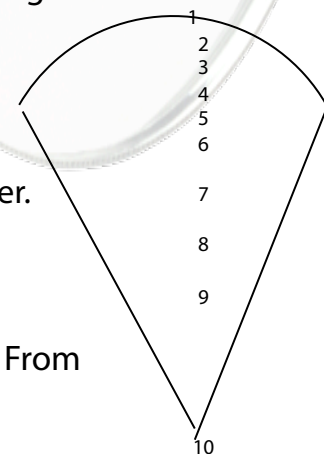
#### Team of Applicants

First Name	Last Name	Why do you think this exhibit is important

### Part 2 - Job Description:

The designers of the exhibit will:

1. Complete a KWL chart to assess what information still needs to be researched before beginning the script for the tour.
2. Use the websites provided to research Earth's interior. Complete the Layers of Earth Chart and use the Scale depth column of the chart to draw a pie-shaped scale model of Earth's interior on the parking lot. See sketch below.
3. Use books, your textbook, and provided websites to research all aspects of each layer. Write an interest-grabbing narrative describing the characteristics of each exhibit stopping point when descending from crust to core. The description must include, but is not limited to, the following information:
  - a. Create the ten stopping points as described in Student Document 4: Layers of Earth Chart.
  - a. The depth of the layer.
  - b. Top and bottom or average temperature of the layer.
  - c. Average density for the materials that compose that layer.
  - d. Show actual samples of rocks that would characterize that layer.
4. Select tour guides from your group to lead the class on a From Crust to Earth Tour using your group script.

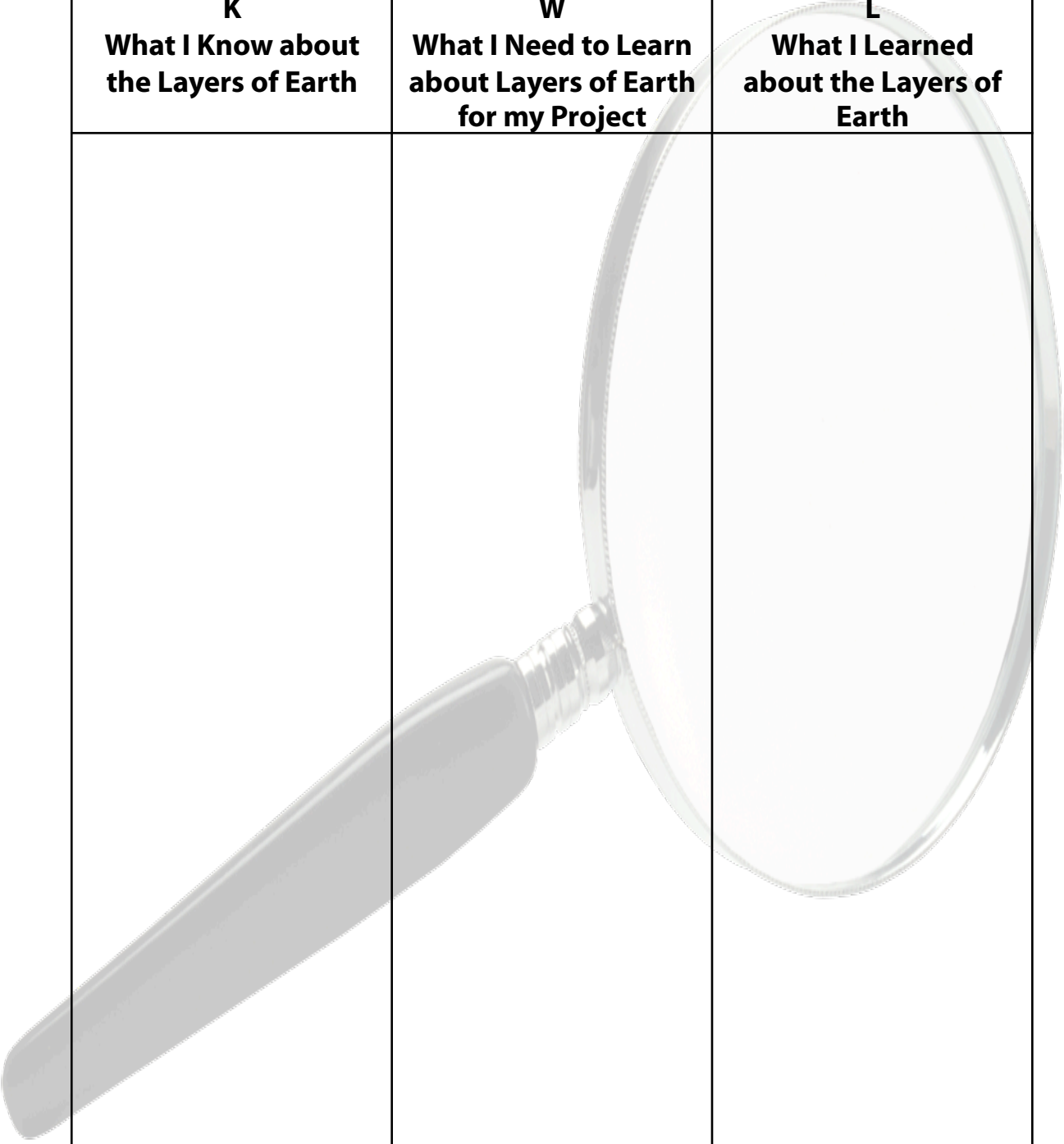




Name: \_\_\_\_\_ Date: \_\_\_\_\_

### KWL Chart -- Student Document #3

<b>K</b> <b>What I Know about</b> <b>the Layers of Earth</b>	<b>W</b> <b>What I Need to Learn</b> <b>about Layers of Earth</b> <b>for my Project</b>	<b>L</b> <b>What I Learned</b> <b>about the Layers of</b> <b>Earth</b>



Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Layers of Earth Chart -- Student Document #4

**Directions:** Complete the Density and Temperature columns

Tour Stop	Depth (km)	*Scaled Depth (m) 1:100,000 (# km ÷ 100)	Name or location	Rock or material sample	Density (g/cm <sup>3</sup> )	Pressure MPa	Temperature (°C)
#1	0	0	Earth's surface	Sandstone		.1	
#2	3.6	.36m (3.6cm)	Deepest mine	Granite		100	
#3	12	0.12m (12cm)	Deepest drill hole	Granite		360	
#4	35	0.35m (35cm)	Bottom of the crust ("Moho")	Basalt		1100	
#5	100	1m	Bottom boundary of the Lithosphere	Basalt		3200	
#6	150	1.5m	Asthenosphere	Basalt		4800	
#7	670	6.7m	Lower Mantel	Olivine		23,800	
#8	2885	28.85m	Core/Mantel Boundary	Liquid iron and nickel		135,800	
#9	5155	51.55m	Innercore/Outer Core Boundary	Liquid iron and nickel		329,000	
#10	6371	63.7	Center of Earth	solid Iron		364,000	

**Pie Shaped Wedge  
Showing Earth's Layers**

(The numbers represent stops on the tour.)

